

ISOTOPIC ANALYSIS OF PRESOLAR GRAPHITE FROM THE MURCHISON KFB1 SEPARATE.

S. Amari¹, E. Zinner¹, and R. S. Lewis². ¹Laboratory for Space Sciences and the Physics Department, Washington University, St. Louis, MO 63130, USA (sa@wuphys.wustl.edu), ²Enrico Fermi Institute and Chicago Center for Cosmochemistry, University of Chicago, Chicago, IL 60637, USA.

Introduction: Presolar graphite grains, the carrier of Ne-E(L), show a range of density (1.6–2.2 g/cm³) and their isotopic features depend on density [1-3]. Low-density graphite grains from the separate KE3 (1.65–1.72 g/cm³) extracted from Murchison [4] are characterized by ¹⁸O excesses, Si isotopic anomalies (mainly in the form of ²⁸Si excesses), high inferred ²⁶Al/²⁷Al ratios (up to 0.1), as well as the initial presence of ⁴⁴Ti (T_{1/2} = 60 a) [5]. These features indicate that they formed in supernova ejecta. Of the other three graphite separates from Murchison, KFA1 (2.05–2.10 g/cm³) and KFB1 (2.10–2.15 g/cm³) also contain grains with ¹⁸O excesses, although the fraction of grains with such excesses is smaller than in KE3 [6, 7].

Amari et al. [8] have reported on a search for the initial presence of ⁶⁰Fe in low-density graphite grains but could not confirm it. ²²Ne in low-density graphite grains appears to be due to the decay of ²²Na (T_{1/2} = 2.6 a) synthesized in the O/Ne zone [9, 10]. One of the radioactive isotopes that are produced in this zone and are of interest with respect to the early solar system is ⁶⁰Fe (T_{1/2} = 1.49 Ma). Here we report on our continuing effort in the search for ⁶⁰Fe in graphite grains.

Results and Discussion: We analyzed isotopic ratios of 15 grains from KFA1 with the NanoSIMS at Washington University. Ten grains have ¹²C/¹³C ratios between 74 and 90 (solar: 89). Only one grain has a ¹²C/¹³C ratio significantly higher (493) than the solar ratio. Two of the three ¹⁸O-rich grains exhibit low ¹²C/¹³C ratios (7.7 and 13.9). One grain with a low ¹²C/¹³C ratio (14.5) but a normal ¹⁸O/¹⁶O ratio shows anomalous Ti with a V-shape isotopic pattern when normalized to ⁴⁸Ti and the solar ratios. The ⁵⁰Ti/⁴⁸Ti of the grain was not determined because of a huge ⁵⁰Cr correction. Grains that belong to this population, characterized by low ¹²C/¹³C ratios (~ 10), are enigmatic: many of them show normal isotopic ratios in trace elements and it is not easy to decipher the stellar sources of these grains. In this study, two such grains, with ¹⁸O excesses, undoubtedly originated from supernovae. The grain with the Ti isotopic anomaly shows a signature of neutron capture. However, it is not clear whether it was produced in a supernova, an AGB star, or a yet unidentified stellar source. ⁵⁷Fe/⁵⁶Fe, ⁶⁰Ni/⁶²Ni and ⁶¹Ni/⁶²Ni ratios of all 15 grains are normal within errors and we still have not obtained any evidence for the initial presence of ⁶⁰Fe.

References: [1] Amari S. et al. 1995. *Geochim. Cosmochim. Acta* 59: 1411-1426. [2] Hoppe P. et al. 1995. *Geochim. Cosmochim. Acta* 59: 4029-4056. [3] Jadhav M. et al. 2006. *New Astron. Rev.* 50: 591-595. [4] Amari S. et al. 1995. *Astrophys. J.* 447: L147-L150. [5] Travaglio C. et al. 1999. *Astrophys. J.* 510: 325-354. [6] Amari S. et al. 2004. *Lunar Planet. Sci.* XXXV: Abstract #2103. [7] Amari S. et al. 2005. *Meteorit. Planet. Sci.* 40: A15. [8] Amari S. et al. 2007. *Lunar. Planet. Sci.* XXXVIII: Abstract #2024. [9] Amari S. et al. 2005. *Lunar Planet. Sci.* XXXVI: Abstract #1867. [10] Amari S. 2006. *New Astron. Rev.* 50: 578-581.